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THE MUSHROOM GROWERS'
ASSOCIATION

MGA

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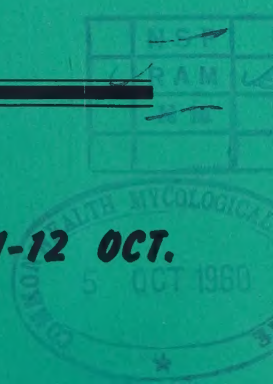
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OCT. - 1960
NUMBER 130

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EDITORIAL

GROWING OLD?

I don't suppose for a single moment that any of you are interested in a Local Government election which took place recently in the small country town in which I live. But you may be interested in a remark which I made about one of the candidates and the quick reply which hit me clean between the eyes. The candidate was a young woman and I remarked to my wife: "What cheek. What on earth does a young woman like her know about local government?" My wife's reply was quick and incisive, so much so that it hurt. "The trouble with you," she said, "is that you forget you are getting old. You're getting set in your ways, you think that because somebody is much younger than you they cannot possibly have any good ideas. You should be a little more tolerant and a little more receptive".

It is to the good fortune of the mushroom industry in the United Kingdom that it is young and vigorous yet there are some among us who hold the opinion that the very peak of regular production is no more than 8 lb. per sq. ft. per year in spite of the fact that, among certain growers, this figure has been left well behind. What is perhaps more important is the tight check some growers keep on cost of production. Profit margin and yields invariably go hand in hand.

There is an up and coming generation of growers who are producing mushrooms with considerable efficiency and who are obtaining yields which a few years ago were not thought possible. It is the same in all walks of life. Our athletes run faster, our aeroplanes travel quicker and quicker and our producers of agricultural and horticultural products are getting heavier and heavier yields. Mushrooms are not the exception. Why on earth should they be?

Please don't misunderstand me. Increasing age is inevitable—there is no escape. But there is a place in our industry for the young just as surely as there is a place for those of us who may well be a little too ready to exclaim, "I bet that includes stalks".

I damned that girl simply because of her age—nothing else. I voted against her—she didn't get in. I could have been very, very wrong.

WRA

SEEN THIS?

Tarpen Hoe/Tiller

Interest has been aroused by the announcement, in Bulletin No. 127 (July, 1960) that Mr. P. B. Stanley-Evans, MGA Chairman, uses a



Tarpen Hoe/Tiller to carry out "shake-up" spawning on shelves.

This interesting little machine was originally produced to work as a garden rotary cultivator, to work in beds and borders inaccessible to the larger machines of this type. It had an operating width of 5 inches.

In 1958, when the machine was exhibited at the Smithfield Show, an enterprising mushroom grower said he would like to try it for "through spawning". A successful trial was carried out and, with the advent of "shake-up" spawning, the machine is now used for this also—a new type blade has been specially designed for mushroom growers' use.

The machine, easily handled by one man, has an overall length of 50 inches. Short shafted machines, for use in a confined space, are also available.

The makers—Tarpen Engineering Co. Ltd., Ixworth House, Ixworth Place, S.W.3. (Tel. Kensington 3491-7)—recommend that, as with all portable electric machines for outside use or use under damp conditions, a low voltage model should be chosen, and operated via a double-wound step-down transformer which runs the machine at 110 volts but protects the operator from any current in excess of 55 volts.

The picture produced herewith was taken on the farm of Mr. Barton of Plummers Plain, Horsham, Sussex.

PUBLICITY IN THE NORTH

Growers in the North of England will be interested to know that the MGA is supporting the Farm Fare Cookery Demonstrations, organised by the NFU during the coming Autumn and Spring. The campaign will include lectures and cookery demonstrations accompanied by special editorial coverage and supporting articles in a number of provincial newspapers. It is estimated that the lecture-demonstration audiences in Whitby, Alnwick, Macclesfield, Sunderland, Lancaster, Mexborough, Driffield and Accrington will amount to 10,000 housewives.

MUSHROOMS ARE BAD TRAVELLERS

A Farm to Retailer Enquiry

Why is there such a vast difference between the mushroom which leaves the farm and the mushroom which is eventually offered to the consumer? Is damage caused in transit and if so, when and where? Can it be avoided?

These are a few of the questions which set Miss Valerie Baker, Public Relations Officer to the MGA, on a journey of investigation which took her down to the farm, on to one of London's main line railway stations at around 11 p.m. one evening, and into Covent Garden Market next day, then on to some street traders' stalls and away to see the retailer who, it was known, had taken away with him, from Covent Garden "the average chip" which had been carefully marked on the farm.

The accompanying pictures, taken with one exception by Valerie's husband, can only give some idea of what goes on but enough emerged to show that the problem is a real one, that damage in transit by rail under the existing conditions is pretty well inevitable and that mushrooms, delivered by road and usually by the grower's own transport, arrive at the market in far better condition than the average rail consignment.

The investigation also spotlighted something which is known to some but may not be fully appreciated by the rank and file of growers—that some mushrooms weather the storm of travel far better than others and, in consequence, command a far higher price. Indeed, on the morning of Miss Baker's investigation, top class road-delivered mushrooms were making 4/- per lb. whilst others, of good uniform size and particularly well graded were down to 3/3d. per lb. Why? Because although they were cups and appeared firm they must have been either carelessly picked, manhandled during grading or had a particularly rough rail ride to the main London station. Or could it have happened when the porter loaded or unloaded, or when the lorry carrying the mushrooms between station and market was being loaded or unloaded? It could have happened at any of the points mentioned. It certainly happened somewhere, as the picture clearly shows.

One thing which emerged quite clearly with regard to rail transport was that thousands of pounds of mushrooms arrive at the main line London stations around about 10.30 p.m. and at the particular station investigated, the lorries arrived quite quickly and the main bulk of mushrooms were moved within the hour.

Can anyone blame the station staff for getting on with the job at a time when railway workers come under particular fire on the charge of alleged idleness? Would you, if you were a porter, handle any produce carefully when confronted by a great mound and knowing that the lorry drivers were impatiently waiting? Certainly the station staff might handle with a little more care but the time taken is extended and there is no more pay!

This handling at the station then, can without doubt be improved, but things being as they are, a chivvying up might bring about an improvement for a short time. A more realistic view is, surely, that

whilst there might be an improvement, without close supervision it just would not last. But we must try—something must be done to ensure, as far as possible, that the mushroom leaving the farm bears a little more resemblance to that which the housewife would like to be offered.

Don't think, by the way, that "Mr. Railwayman" is the only offender in this. Take a look at the picture which, taken in the market, shows chips of mushrooms, three to a layer and stacked 13 chips high! That's a combined weight on the bottom chips of something well over 75 lb. Is there anything unusual in this? "No" said the first grower questioned, adding, "I take my own chips into market and frequently stack that high!"



Chips in the market stacked 13 high !

What the Railwaymen say. Questioned during the unloading at the main line stations, porters had these things to say:—"Some of the chips are not very strong—no wonder they are damaged". "Many of the lid designs are difficult to read—naturally enough where they come from is not important to us. We want to know where they are going. There should be as much space as possible on the lid for the destination". "Special coloured lids for respective wholesalers is a good idea but some growers will mix them up". (*So will some railwaymen—Ed.*). This particular porter added "We unload a batch of chips for one salesman, then find a second batch for another salesman, and underneath the lot

we might find chips for the original salesman and by that time that

MUSHROOMS ON A LONDON STATION



Top (L) : Inside a rail van
Bottom (L) : On the platform

Centre: What happens when two barrows
collide - and they remained like this for
nearly an hour.

Top (R) : Inside a lorry
Bottom (R) : Out you go. Chips ready
to be placed on a rail barrow. Note the
one upside down

lorry might have gone!" He added that it wasn't at all easy to read instructions in the dim light of the station. "Make the addresses plainer," he said.



Mr. Hardboard with Mr. Curtiss from St. Martin's Fruit Stores, Stratton Ground, S.W.1, discussing the average chip far less damaged than those travelling by rail".

What the Salesmen say.

Mr. Hardboard of T. J. Poupart Ltd. stressed the point that white clean mushrooms will always make the higher price irrespective of the packing, although the better and stronger the pack the better the mushroom, generally speaking. Added Mr. Hardboard: "In general, those mushrooms which arrive by road are

Mr. Smead of R. Jenkinson Ltd. was another who stressed the need for strong durable chips. He made the point that a poor quality chip was usually accompanied by a poor quality lid, and that didn't help as a good lid often strengthened the package in general.

The Barrow Boys. In London and in all the major cities and towns, "barrow boys" appear to handle a great deal of mushrooms and although many of them visit the market late in the day and, at low prices, clear the market of mushrooms which may at times hang fire (and thus perform a useful service to all concerned), some street traders deliberately cater for quite a high class market, taking care with display and charging according to the quality of the mushrooms on show. One stall in Rupert Street, London, sells 300 chips per week in summer and many more in winter, when prices are firmer. They particularly welcome recipe leaflets as an aid to sales. One "enterprising" stallholder was boldly advertising "Kentish Mushrooms" although his supplies came from Sussex and at one of the farthest points in that county from Kent.

The Retailer. It will come as no surprise to know that the retailer would welcome supplies of clean, fresh mushrooms, "Sales would go up without a doubt and the price too would even out with the more even quality" said one. This "Average Chip", which was followed through from farm to shop eventually appeared in the shop on display **about 26 hours after it was picked.** By that time the mushrooms had already

See opp.

You takes 'yer pick (top): 1.- per half pound on the flanks and 1/6d a half in the centre - and for well displayed flats!

Centre: The "average chip" with its attractive MGA publicity cover.

Bottom (L): Kentish mushrooms all the way from Sussex.

Bottom (R): More flats, again well displayed and graded - at 9d per quarter. With the exception of the chip, all the pictures deal with barrow boy displays.



begun to look "tired", the cups had opened out as the picture shows, and the stalks had lengthened and had begun to turn a noticeable brown in colour. By the time the last half-pound was left, they bore little resemblance to the farm quality. The actual picture was taken 32 hours after picking—half an hour later all the mushrooms were sold.

Conclusions. It would be quite easy to reach some sweeping and maybe nebulous conclusions from what happened to this average chip of mushrooms, but what is required are constructive ideas which stand some chance of being carried out.



Centre—Mr. Smead, Mushroom Salesman for R. E. Jenkinson Ltd. Right—Porter about to load truck

One obvious point which emerged was the value of a chip of reasonable quality and, on this point, one salesman said: "There are many growers who save a few pence by buying cheap containers and lose £'s because the mushrooms are easily damaged. This is particularly so when mushrooms travel long distances and by rail. I cannot over

emphasise the difference this makes in the price I can get".

It seems pretty certain that growers who are able to deliver their own mushrooms direct to the market are in a position of considerable advantage and the extra price their produce commands still leaves them a comfortable margin when the additional costs are taken care of.

There is wide scope for better handling by the railways and representations might bring about some improvements, but the human element is very largely involved and, whilst the railways might be persuaded to improve matters such improvement is unlikely to be sustained. Some representation is obviously called for.



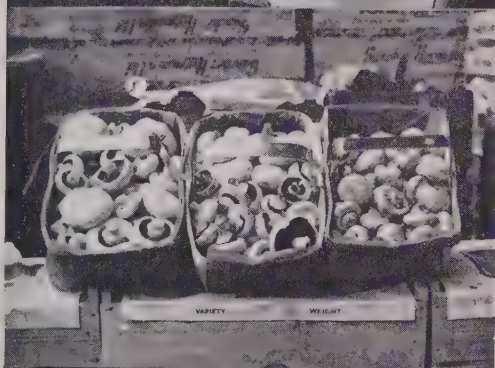
What happens when poor quality chips are stacked

THIS IS THE "AVERAGE CHIP"

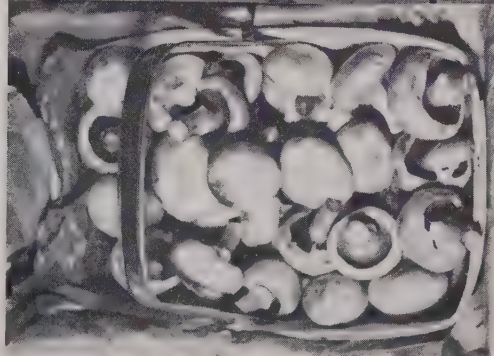
This is what it looked like soon after being picked on the farm.



Here it is in Covent Garden Market (centre) with a top class chip on the left and a poor quality one on the right.



And this is what the "average chip" looked like in the retailer's shop.



Direct sales are one of the ways in which the mushroom can be presented to the public farm fresh. For those growers who are so situated this type of sale offers a golden opportunity. Many are already taking advantage of this vast market and, again obviously, the sales or sales potential have to be such as to justify the initial experiment. The smaller producer is at a serious disadvantage here in that he may not be able to guarantee a continuity of supplies and he would be unwise to attempt to build up a local connection and suddenly find himself unable to meet orders.

With the larger grower, particularly in some parts of the country, there is the danger of overlap and the danger too, of price cutting. Agreement on these two points should not be difficult.

And increased direct sales and increased sales through the wholesale markets would go hand in hand and both outlets are absolutely essential and need not conflict.

In short:—

1. The container needs to be strong with a strong lid.
2. Representations should be made to British Railways.
3. Increased deliveries by road are called for.
4. An increase in local sales is desirable.

WRA

GRASS AND PINHEADS

It makes no difference



On Page 89 of Bulletin No. 123 (March, 1960) Mr. Middlebrook wrote:—"Many must have thought of it, but few if any have tried it: the idea of sowing grass seed in peat at time of casing". Mr. Middlebrook, somewhat coyly perhaps, suggested that pinheads might be less reluctant to appear under such circumstance.

Mr. John Scrimgeour of Dorset, in sending the above picture writes:—"I tried this some time ago and can report no change in cropping". "Perhaps" he added, "I sowed the grass seed too late".

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231. An element of inaccuracy is evident in almost every paragraph of the Luxmoore protest (Bull. 129). Words of un wisdom have been pronounced by many, from the top (scientific) brains down through the middle (grower) brains to the lowest (Pinhead) brains. There is no sense allowing the chaff to remain in with the wheat. Luxmoore would have me believe everything I hear from any source. He would particularly have me pay well to hang on to his own know-all, infallible lips. It is untrue to suggest I am indifferent to free advice. I'll take any *good* advice, free or otherwise. Experience shows that so much advice is bad and one gets into the habit of analysing *any* advice very carefully before applying it. It's not a bad policy and L. knows it.

The inference in his protest is that he and he alone discovered the importance of straw. Interesting! Atkins recently went through the same phase, staking *his* claim. Very interesting! The plain fact is that all three of us had discussed the possibilities by phone, letter and conversation over a protracted period *before* Luxmoore came up here to deliver himself of his opinion, which in fact was a résumé of our three opinions.

Activators never vary, says L. He may well be wrong about that too. But if he's right, with his unvarying activators and a perfection of treatment which we must suppose his advanced and superior knowledge would enable him to apply, he should have had consistent crops from synthetic compost. He knows as well as anyone else that synthetics results vary as much as those from stable manure. No doubt he puts this down to variable straw. He could be partially right, but why all the blah about it?

Because *our* stacks resembled wet green sea-weed (an apt and agreed description!) *he* was in a good position to give an opinion on straw. Only a warped mind could trace any logic in that.

We have never claimed super crops—unfortunately. Our jump from 1.5 to 2.5 with better harvested straw was from bad to good, not to super. Yet, according to L. something around what he calls good (presumably about 2.5 average) is the maximum attainable, so you could argue that 2.5 is indeed “super”. Which is nonsense.

If L. is correct about crop maximum several growers in this country must be unashamed liars. Luxmoore's 2.5 max. average (or whatever his actual limit is) will be from 7" or 8" shelves. He would not expect that figure from 4". What has he to say, except that they are liars, of those who are currently averaging 2.5 from 4" in 6 weeks? And what of those, some of whose word I personally do not doubt, who are doing 4 lb. average in 8—10 weeks? Could L. do 4 lb. average in 12, 16, or 20 weeks? I doubt it. Let's face it: it is just possible there are some better growers than L., and by inference doubly better than S.M.

232. Following the collapse of prices in the last week of June (see my recent price chart) there has been a welcome lift. According to Secretary Alderton many growers have indicated that their average

price this year is appreciably higher than last—up to $2\frac{1}{2}$ d. higher. For the first 8 months of last year our average price was $2/11\frac{1}{2}$ d. against $3/0\frac{1}{2}$ d. for the same months this year. Despite the recent lift we seem to be lagging appreciably. I must speak to Sales.

233. After a period of comparative freedom from the trouble, we are once again having a lot of late market deliveries. The Railways' explanation last time (around November and December) was that Christmas traffic was disorganising movement. With shops already displaying Christmas goods, and Christmas cards being plugged from June onwards, this Christmas traffic excuse will soon last for 12 months each year. Add to this the fact of road traffic speeding itself to a standstill, and you will soon find all produce anchored at source with would-be customers dying by thousands in car-shaped coffins and stationary rolling stock. This will be applauded as a high standard of living.

234. There is every indication that there will be a serious shortage of straw in the near future, and what there is will be poor quality. Increased growing area with reduced supply of straw suggest an urgent search for a substitute. But please, Scientists, for the love of Mike don't find one so plentiful and easy to handle that every back garden and window box will flourish at 6 lb. per sq. ft. 6 times a year.

235. It is amazing how many questions one asks about each crop on one's daily round. What compost did it have; what sort of peak heat; condition after peak heat; how well did the spawn grow, at what temperatures, etc.; how many days is the crop from filling; what weight up to date; what flush are we at; when was it last watered and how heavily; how wet was the peat at casing; how much moving air applied? And so on. To provide the answers readily and to avoid incessant journeys to inspect records in the office, we have arranged for very comprehensive crop cards to be hung and maintained in each shed. It works well. All the information is there for instantaneous use. All questions can be answered on the spot, immediately. One snag: no questions are now asked! Every available moment is spent in keeping the cards up to date! So we must return to relying on memory, which plays us false anyway. So back still further to basic principles, forgetting records, information and memory: Make a first-class compost and everything else will take care of itself. **MAKE A FIRST-CLASS COMPOST** don't make me laugh!

236. Far from being one of those cock-sure permanently successful types with which our industry is well spawned, I have experienced, recorded and charted so many failures in the past 24 years that I would take pleasure in announcing that our recently changed composting method had produced outstandingly improved results. If it were true. But it isn't. Crops are down—down—down. Chorus of the Boffins: "We told you so." Nevertheless, we shall live . . . to laugh at this hereafter (Shakespeare: misquoted?).

237. I see we are to have a conference lecture at 12.15 *a.m.* Tuesday. The subject will be Heating, and could hardly be more appropriate at such an hour.



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BELGIAN CAVES STAGGER MGA PARTY

Tremendous Potential

M. Guy de Man, who lives in Brussels, is well-known to many English mushroom growers but only a few of them are aware of the extent of his mushroom growing activities.

Members of the MGA party, visiting the Continent in June, were quite staggered at the scope of M. de Man's growing in the limestone caves at Kanne, situated on the Dutch-Belgian border.

These huge limestone caves, first excavated in Roman times, are 120 feet below the surface, driven under a huge hill. The galleries are some 30 ft. high.

The extent of these caves can be judged by the fact that the total free surface area is 550,000 sq. ft. At the present time M. de Man is using 16,000 trays each measuring $5\frac{1}{2}$ sq. ft. Growing area is thus around 88,000 sq. ft. The weekly fill was 1,000 trays and this has now been stepped up to 1,500.



Roller conveyors are used for the trays, seen here on the way from the peak-heat room to the growing room. They are spawned at this point

Horse manure is the basis of the compost and the delivery lorry drives right in to one of the large galleries where composting takes place. Actual composting takes 11-12 days, with about $6\frac{1}{2}$ lb. of Urea per ton added at stacking. At the first turn three days after stacking nearly 9 lb. of ammonium sulphate is added for each ton of manure. The second turn follows three days later followed by the third with the addition of 25 lb. of powdered chalk per ton, at an interval of three days. The trays are filled three days later. Pasteurisation temperature is 138° F. and is varied from one to three days, according to the need of each individual

compost. Spawning takes place at 75° F. and the casing material is 75% limestone obtained from the caves and 25% peat. There is no subsequent

crop watering at all throughout the crop, with the exception of a few trays near the entrance to the caves. These tend to dry out. Growing temperature is maintained, through the application of hot air, at 61° F. and picking period extends to eight weeks.

The mushrooms are all of the button type and are sent daily to the auction. It is the auction which decides what amount shall be placed on the fresh market and the amount to be sent to the cannery. Average price throughout the year is about 2/4d. per lb.

Broadly speaking there is little mechanisation but roller conveyors are in use at spawning and casing times and trailers, each carrying thirty trays, are tractor towed three trailers at a time.



The type of trailer used inside the caves. Compost is being emptied well away from the entrance to the caves

The average compost depth is 3-4 inches and just over 400 sq. ft. of beds are laid to one ton of manure. Much less trouble is taken with regard to an even depth casing layer than is the case in the United Kingdom. This is due to the fact that relative humidity, at 98%, is very high.

Production is at 1.1 lb. per sq. ft. No mention was made of the cost of production but it was obviously pretty low.

Labour staff consists of a manager and fourteen other workers.

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FRESH FOOD PACKAGING EXHIBITION

Many mushroom growers are expected at the Fresh Food Packaging Exhibition which takes place at Alexandra Palace, London, from 4th to the 6th November, and included in the seventy or more firms which are exhibiting, occupying over 25,000 sq. ft. of floor space, are many leading U.K. container manufacturers. Machinery, materials and methods of fresh food packaging and display are to be fully exploited. The exhibition will provide growers with up-to-date information on all aspects of fresh produce packaging and marketing.

The fact that there are now more than 7,000 self-service grocery stores in this country will give the exhibition added interest.

Alexandra Palace is easily accessible by underground, bus or car and there are adequate car parking facilities. Complimentary tickets can be had from Brooks Publicity Services, 6 London Street, Paddington, W.2 (Tel. 6672).



The visitors pictured outside the packing shed.

NOTTINGHAM FARM WALK

A farm walk took place at Bestwood Park, Nottingham, on 24th August, and, because of its size (there are 8,000 sq. ft.) invitations were, on this occasion, restricted to Grower Members of the MGA in Area C, the arrangements being made for the Area Committee, of which Mr. F. C. Atkins is Chairman, by Mr. N. R. Cooper the Hon. Secretary.

The farm is owned by Mr. S. Cwynar who, like so many of his Polish compatriots, found himself stranded in England following a distinguished record with the Polish Freedom Forces in the Second World War.

This Bestwood Park farm is comparatively new as Mr. Cwynar founded it a year or two ago on having to leave his farm in the city of Nottingham.

Mr. Cwynar (pronounced "Sweenar") has his 8,000 sq. ft. in Handcraft type houses. He grows on the shelf system with bowed beds, about 8 inches deep at the sides and 12 inches or more in the centre.

A stack of about ten tons of stable manure is allowed to lie three or four days and is then turned three or four times at intervals of two days. At the first turn and again at the second, $2\frac{1}{2}$ cwt. of gypsum is added. A total of 5 cwt. of activator, blood and organic, is also added to the pile which is watered at each turn, if considered necessary. Once in the growing houses the beds will heat up to 140° F. Casing is made up of the usual combination of peat and chalk, the proportions being 1 chalk to three peat, by volume.

The houses are organised on a 18 week cycle including an 8-week picking period. Spawning takes place when the bed temperature has dropped to anything between 80° F. — 95° F. and a house temperature of about 62° F. is maintained throughout the growing in the cooler months although no heat is used in summer! Mr. Cwynar believes in plenty of fresh air in the houses and uses a large re-circulating fan to ensure regular air movement.

Over the past year a production of 3 lb. per sq. ft. 3 times a year is claimed for this farm—a typical small shelf farm, similar to many dotted about the country, farms which, in spite of competition from larger farms, continue to operate quietly and efficiently.

Following tea and question time, Mr. and Mrs. Cwynar were cordially thanked, on behalf of the visitors, by Mr. Atkins.



Mr. Cwynar emphasising a point (how to firm beds?) when talking with the brothers Titley from Ludford, Lincs. Some of the growing houses are seen in the background.

GRANT AID — QUALIFYING AREA

Confusion seems to exist in the minds of some growers regarding the area which has to be multiplied by twenty when considering the basic area of four acres on which the Government's Horticultural Grant Aid Scheme is based and through which, some £8 million has been made available to horticulture in general, in an effort to bring about increased efficiency.

It cannot be over-emphasised that the grant is not an aid to actual production and, heating systems apart, the erection, alteration and

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7.30 p.m.

This evening is intended to be an informal, yet educational "get together" for Growers and we are greatly indebted to the following, who have kindly consented to contribute a short talk.

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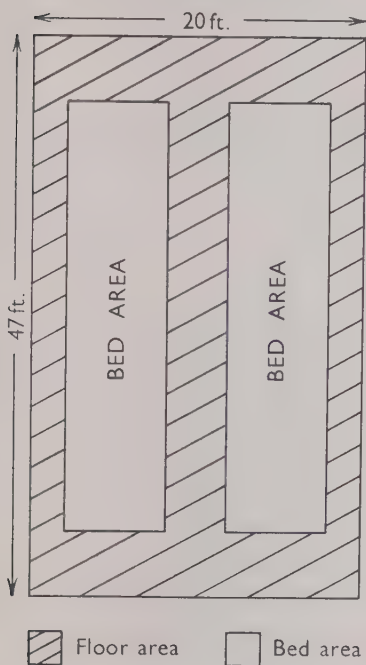
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repair of growing houses does not qualify for assistance. Tractors, turning machines, trucks and so on, also do not qualify. Changes calculated to increase the heating efficiency of mushroom farms do qualify for grant.

Floor diagram of
Mushroom Growing House



The diagram produced herewith indicates the basic *floor* area (shaded) which should be added to the basic *bed* area of a house (whether the trays or shelves are in tiers of three, four or more). The basic floor area plus the bed area should be multiplied by twenty, thus giving the basic qualifying area for each house.

Taking the diagram as an example, the basic floor area is $20' \times 47'$ which equals 940 sq. ft. From this figure deduct the area occupied by the bottom beds, say two runs of shelves each measuring $40' \times 5'$ which equals $40' \times 5' \times 2' = 400$ sq. ft. Deduct this from the original 940 sq. ft. and the figure left is 540 sq. ft. To this figure has to be added the total area occupied by the beds. In the example quoted and assuming there are two tiers of three shelves each, the qualifying shelf area is $40' \times 5' \times 6$ (total number of shelves) which = 1,200 sq. ft. This basic bed area of 1,200 sq. ft., plus

the qualifying floor area of 540 sq. ft., gives a total qualifying area for this house of 1,740 sq. ft. As the total qualifying area in the case of mushroom growers is 8,712 sq. ft. (8,712 sq. ft. times 20 equals 4 acres) a shelf farm with only five such growing houses is eligible under this scheme. In the case of tray growers the number of houses would be less where each house of the dimensions quoted contained—as is often the case—a greater bed area than a normal shelf house.

In addition to the examples quoted, the floor area of any spawn running or growing-on rooms can also be added. Whether or no the actual area of beds in these additional rooms can be included has not been clarified, but is certainly worth a try.

It will clearly be seen from the figures given that the farms of the great majority of MGA Grower Members are of the qualifying size.

There are reports that growers are not taking full advantage of the scheme and members might like to be reminded of the wording of the Schedule outlining the work for which a grant may be claimed.

Members are urged to make a close study of the Schedule of Improvements for which grants may be paid, which appeared in Bulletin No. 124 (April, 1960), pages 131-132. The attention of members is drawn to the facilities offered for building, altering, enlarging or recon-ditioning *permanent* buildings on the farm (Part 1a) not including growing houses; the improvement of heating systems (b) and the wide range covered by Part 3.

It would be little short of tragic if full use was not made of the grants available under this scheme.

HORTICULTURAL EDUCATION ASSOCIATION

VISIT TO AGARIC CAVES

By **Norman McP. Young, C.D.H.**

(*Hort. Adviser to Eclipse Peat Ltd.*)

One of the highlights of Horticultural Education Association's Autumn Conference this year was a visit to Agaric Limited of Bradford-on-Avon.

Membership of the H.E.A. is comprised of Horticultural Advisers of the Ministry of Agriculture and of Local Education Authorities, Horticultural Lecturers at Universities, Colleges, Farm Institutes and Horticultural Research Workers. The Autumn Conference is the main event in the Association's Annual Calendar and this year it was centred on Bristol, from 5th to the 9th September, at the University.

On the afternoon of Tuesday, 6th, 150 members found themselves completely absorbed by the technique of mushroom growing in under-ground stone quarries. The whole process was demonstrated stage by stage from beginning to end, from the special machine turning the compost, to the peak heating houses, spawning, and then by fork lift truck to two large hanger type spawn-running rooms capable of dealing with one million square feet per annum and fitted with the latest humidifying equipment. The sequence then continued through to the casing shed and finally to the stacked boxes in the quarries, where a very fine crop was being produced.

The visiting H.E.A. members were indebted to Mr. A. G. Pointing, his two sons, and Mr. Nommenson for the highly organized manner in which they conducted such a large party round. Loud speaker equipment was stationed at various points and the intricate route through the quarries was specially illuminated for the occasion, and no effort was spared in laying on special demonstrations at each stage of production.



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The MGA's Financial Year ends on 31st October, and the Secretary would be pleased to receive any subscriptions due before that date.

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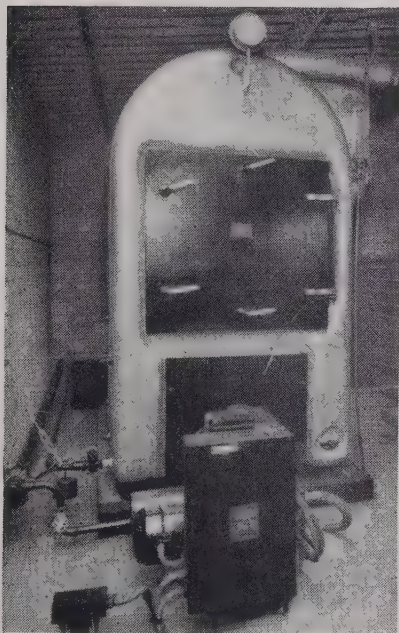
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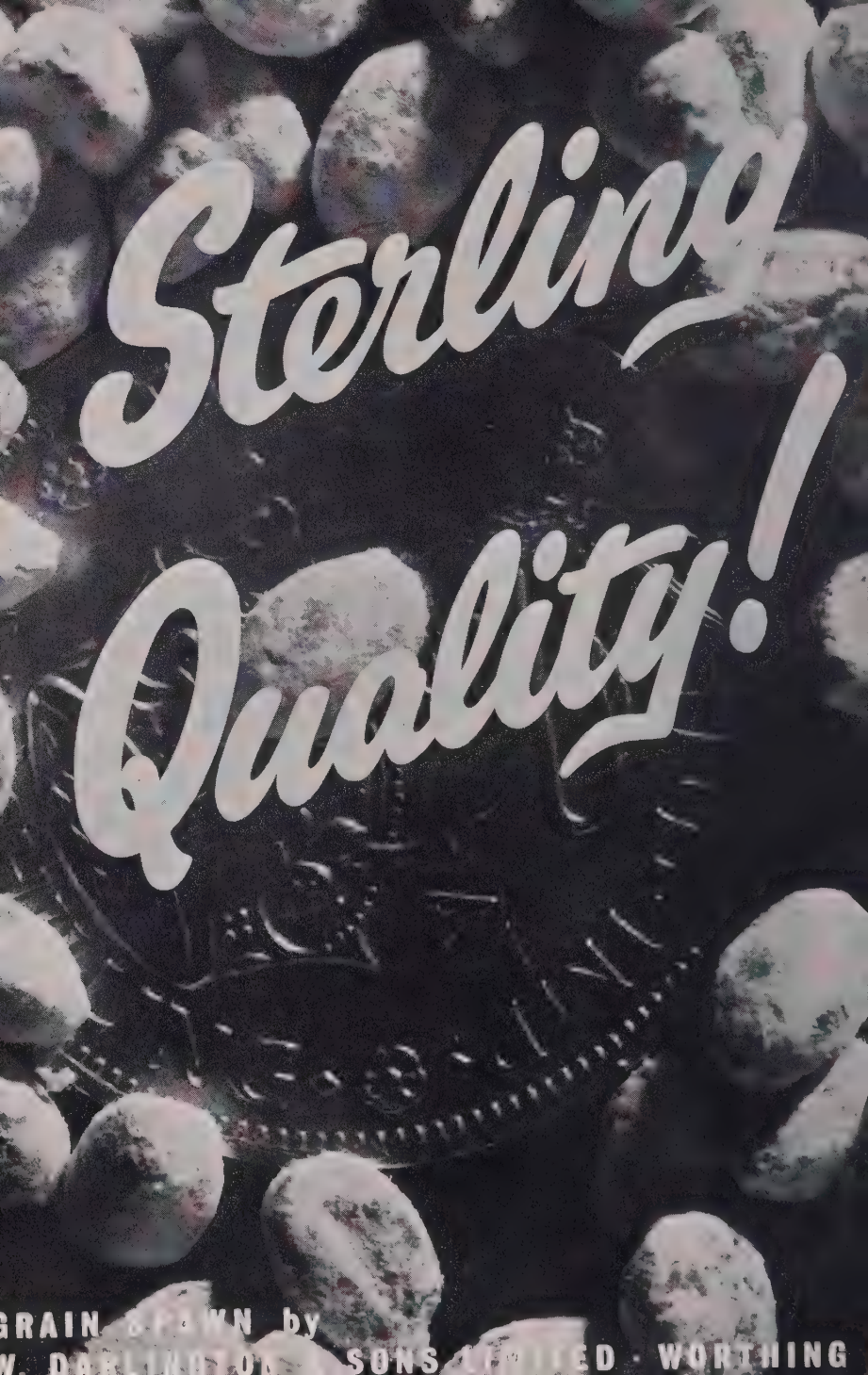
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MUSHROOM GROWING — THE LINFIELD WAY



These pictures were taken on the Lyons Farm Nursery of Messrs. A. G. Linfield Ltd., of Thakeham, Pulborough, Sussex, the largest mushroom growers in Europe. Dare we say that this is some flush—which may perhaps produce a blush here and there! The top picture gives a general view of one of the spacious houses—converted glasshouses. The picture below gives some idea of the quality of the mushrooms.

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STUDIES ON THE INFLUENCE OF CARBON DIOXIDE ON THE CULTIVATED MUSHROOM

By **Dr. H. J. Tschierpe**

Institut für Gemüsebau der Technischen Universität Berlin

Direktor Prof. Dr. H. Riethus

(The original paper was published in "Die Gartenbauwissenschaft 24, 1, 18-75, 1959)

E. Studies on the Influence of Carbon Dioxide on Fruitbody Initiation

In the last section experiments were described which proved the morphogenic influence of carbon dioxide on the fruitbodies. In these experiments the results of **Lambert's** experiments were confirmed, more accurately by using a modern CO₂-determination apparatus, and **Stoller's** and **Mader's** hypotheses were disproved. It now seems necessary to find out whether carbon dioxide has any significance for fruitbody initiation.

For more than 250 years—as long as mushrooms have been cultivated—the mycelium impregnated compost has been cased with a layer of soil in order to induce fruitbody formation (**Tournefort**, 1707). The large number of casing soils with very different physical and chemical properties, which are successfully used in practice make it very difficult to ascertain the function of the casing soil and its real function has never been proved experimentally.

Magnus (1906) was the first who saw that the superficial growth of mycelium on the casing, often observed in insufficiently ventilated cellars, can be caused artificially by putting bell jars on to the cased mushroom beds. Under the bell jars developed a "white, loose felt", "whilst on the parts of the bed not covered with bell jars normal pinhead formation occurred".

Magnus suggested an influence of external factors on the fruitbody form, "but whether the higher oxygen—or lower carbon dioxide—or water vapour—content is effective remains to be resolved" (**Magnus**, 1906, p. 90).

Styer (1930) also suggested a connection between ventilation and fruitbody initiation. He points out that in practice fruitbody formation can be caused by watering the beds. He is inclined to believe that fruitbody initiation could be caused by a reduction of aeration of the bed and watering can be a means of reducing this aeration.

According to **Hein** (1930) fruitbody formation can occur one to two centimeters beneath the casing soil surface. In uncased beds or in very loosely filled beds **Hein** observed fruitbody formation 12 to 15 cm. beneath the surface. **Hein** stated that the change to the "aerial environment" is obviously a characteristic for fruitbody formation.

Mader's (1943) results concerning fruitbody initiation are a confirmation of **Magnus'** experiments (1906): If spawned and cased beds are not ventilated, the mycelium grows through the casing layer, spreads on the casing and the fungus does not form sporophores.

Lambert (1939) and **Edwards** (1949) explain the stimulating effect of the casing layer on fruitbody initiation according to the **Klebsian** theory: the mycelium grows from the "rich" medium (compost) into the "poor" medium and in that way is stimulated to sporophore formation.

According to **Edwards** (1950) it is furthermore probable "that the start of fruiting, the number of mushrooms and the occurrence of flushes, are also affected by casing soil and by micro- and macro-climate" (**Edwards**, 1950, p. 39).

Pizer and **Leaver** (1947) draw from casing soil experiments the conclusion that metabolic products could possibly influence fruitbody formation: "... these would appear to be strongly held by the soil and require close contact with air to be effective". Furthermore they assume that "... the formation of sporophores on the strands requires contact of the surface of the soil with air, or contact of the strands with air". (**Pizer** and **Leaver**, 1947, pp. 43/44). **Voderberg** (1949) air the opinion that the fruiting of *Coprinus lagopus*, which belongs to the family of the Agaricaceae, is "neither considerably influenced by the temperature and moisture nor by the acidity of growing medium". Fruiting substance or a partial exhaustion of the substratum in her opinion cannot be responsible for fruiting. **Voderberg** summarises fruitbody formation in *Coprinus lagopus* as a "common effect of a mycelium complex".

Middlebrook and **Storey** (1950) recognized an obvious relation between air-space/bed-surface ratio and fruitbody formation. The more air space existed per square foot of bed surface the higher were the crops and the shorter was the time necessary to produce 1 lb./sq. ft.

Bels-Koning (1950) concludes from all the measures carried out in practice for fruitbody initiation (casing of beds, ventilation of cropping rooms, decrease of temperature) that for fructification a water gradient from the compost and the casing to the room-air is necessary. The same interpretation had already been given by **Zycha** (1939) according to which "a certain (water-) vapour-pressure gradient between the mycelium, compost and surrounding air" might be the trigger mechanism for fruitbody initiation.

Stoller (1952) supposes that a volatile oxidizing substance diffuses from the mycelium. "It appears that the oxidizing intensity of this substance is so great that it prevents the thickening at ends of the strands of hyphae from which the sporophores develop". According to his view the casing soil must be a medium for rapid oxidation and reduction reactions in which this substance is oxidized and hence destroyed.

An oxygen supply, i.e. air movement, is naturally necessary for these reactions. **Stoller** (1952 b) supposes furthermore a hormone-like action of this substance, which has different physiological effects at various concentrations. When present in large amounts, it stimulates mycelial growth; when it is destroyed in the casing soil by oxidation reactions and is only available in small amounts, then the basis for fruitbody formation is provided.

Schisler (1956) proved that the Klebsian theory is not applicable to the fruiting of the cultivated mushroom in the way **Lambert** (1939) and **Edwards** (1949) suggested. **Schisler** cased the beds with normal composted unspawned compost and he obtained a normal crop. He disproved also the supposition of **Bels-Koning** by pumping water-saturated air over his cultures in Erlenmeyer flasks. In spite of the absence of a "water-gradient" normal sporophores developed. Also in view of **Schisler's** results **Stoller's** theory seems not to be valid. **Schisler** cased beds with pure silica sand (99.9% SiO_2) and normal sporophores developed. If the beds were not cased at all but watered at certain intervals, something like a "water-casing-layer" was created, likewise normal mushrooms appeared. From consideration of these results **Schisler** proposes the following mechanism of fruitbody formation: "A hormone-like substance of high molecular weight and very low volatility is produced by the mycelium. The function then of any casing layer is to inhibit sufficiently the volatilization and/or diffusion of this material, so that a certain concentration is obtained to provide the stimulus for fruiting in the mycelial network of the compost. The same substance may also inhibit fruiting if present in too great a concentration by adversely affecting the strands or rhizomorphs in the casing layer". (**Schisler**, 1957, p. 48). **Schisler** brings no proof for the existence of this substance. Except for the above-mentioned results his experiments show only that for fruitbody initiation a rather high air-movement above the casing soil is necessary, that the CO_2 -concentration differs above the casing soil, and that growing sporophores develop large amounts of carbon dioxide.

Koch (1958) found no connection between the availability of several carbon- and nitrogen-sources and fruitbody formation of the cultivated mushroom. He supposes that for fruitbody initiation water soluble substances of the compost are necessary. Furthermore from his experiments in jars **Koch** came to the conclusion that aeration plays an important part in fruitbody initiation.

In the following experiments the same methods were applied as in the studies on the influence of carbon dioxide on the fruitbody form. The different treatments, however, began immediately after casing.

2. Results

Four compost-filled and spawn-grown jars were put, immediately after casing (day 0), into one culture box each and ventilated with a CO_2 -free airstream (set A). Airstream: cylinder with compressed air—gas wash bottle filled with N/1 NaOH—gas wash bottle filled with distilled water—distribution with T pieces into four culture boxes—outlet into room air.

Four other jars (set B) were ventilated with an air, enriched with 0.5 volume per cent carbon dioxide. Airstream: cylinder with compressed air—gas wash bottle filled with distilled water—distribution with T-pieces into four culture boxes—outlet into room air.

The relative humidity in both sets was approximately 100 per cent. Throughout the experiment there were small water drops on the inner

walls of the culture boxes. The temperature in all experiments was between 16 and 18° C. In both sets the air was renewed 10 times per hour in each culture box.

Situation on the 7th day

Set A: The mycelium grows between casing soil and wall of the culture box to the casing soil; the first strands are visible.

Set B: As in the A-boxes the mycelium grows to the casing soil surface, but no strand formation occurs.

Situation on the 14th day

Set A: In all A-boxes growing sporophores; no mycelium on the casing.

Set B: The casing soil of all B-boxes is densely overgrown with mycelium. Single tiny pinheads.

Situation on the 17th day

Set A: In one culture box the first sporophore ready for picking. In all other boxes developing buttons.

Set B: The surface of the casing is densely overgrown with mycelium. The single tiny pinheads (2 to 3 mm. in diam.) do not grow further but are overgrown by the mycelium. The mycelium grows at the outer walls, down to the bottom.

From each set one box is taken away and replaced by a later cased box with fruitbody development beginning (see figure 32 and 33). The boxes taken away were placed in normal room air.

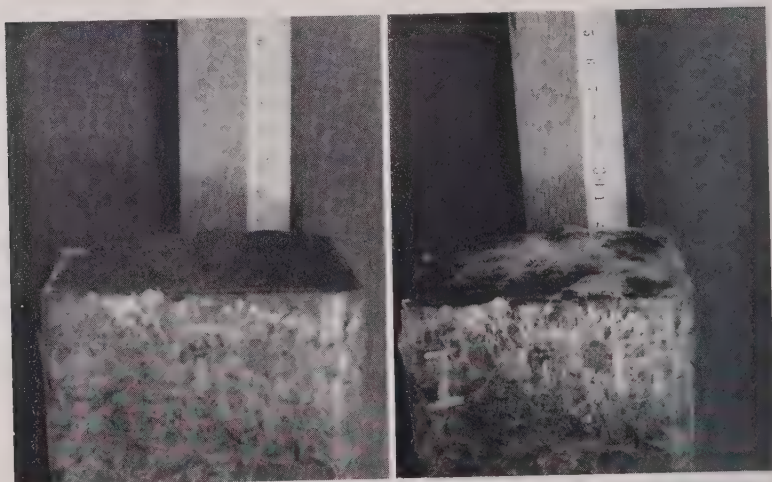


FIG. 32: Left. box with beginning of fruitbody formation. Right: After twelve days ventilation with an airstream of 0.5 volume per cent CO₂-content. A clear mycelium grown on the casing. Pinheads do not grow any further.



FIG. 33: Left, box with fruitbody formation beginning. Right: After twelve days ventilation with an airstream without carbon dioxide. No mycelium growth on the casing soil, normal fruitbody development.

Situation on the 21st day

Set A: Fruitbodies in all boxes. Total yield 82.00 g; cap weight 56.00 g i.e. the ratio of cap: stipe weight is about 2 : 1. The box placed in set A on day 17 shows no reaction.

Set B: No fruitbody formation. The tiny pinheads are overgrown with dense mycelium, mycelium also at the outer walls of the culture boxes. On the box placed in set B on day 17 hyphae grow at the casing surface. After picking the sporophores from the A-boxes, one box of set A was changed with one of set B overgrown with mycelium.

Situation on the 24th day

Set A: In the two boxes which had been in an airstream without carbon dioxide for 24 days the second flush develops. On the box put into this treatment at day 17 one fruitbody develops. The box put into set A on day 21 shows no reaction.

Set B: Dense mycelium on the boxes which have had 24 days in the air-stream with 0.5 per cent carbon dioxide. Also mycelium on the surface of the box put into this treatment on day 17. The box put into set B on day 21 shows no reaction.

Situation on the 28th day

Set A: Fruitbody development in all boxes. In the box from set B fruitbody formation beneath the superficial mycelium.

Set B: Dense mycelium growth on the casing surface of all boxes (see figure 32).

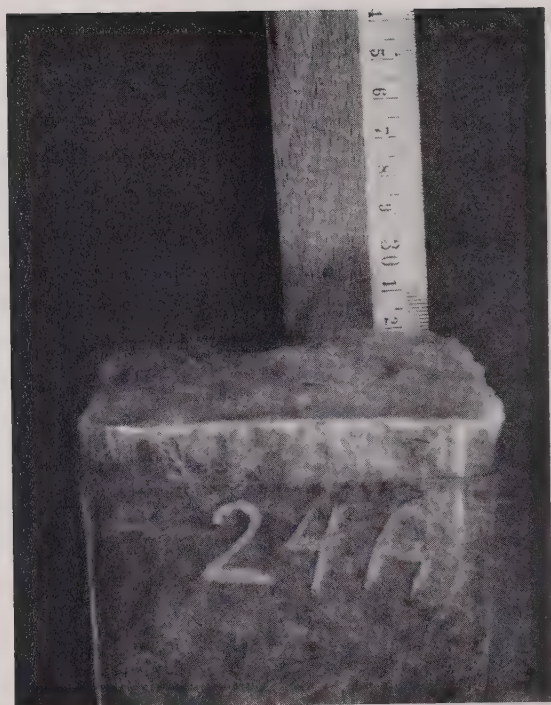


FIG. 34: The box changed on day 21 from the CO₂-free airstream (set A) to the airstream with 0.5 per cent CO₂ (set B), on 29th day. Dense mycelium growth on the casing soil, existing pinheads are overgrown by the mycelium, the mycelium grows at the outer walls. There was no mycelium at the surface on day 21, when the treatment began.

The experiment was concluded after 35 days. During this time 12 sporophores with a total weight of 156 g were cropped (that is equal to 1.28 lb. sq. ft. in two flushes). The ratio cap : stipe weight was about 2 : 1. In set B, ventilated with an airstream with 0.5 per cent CO₂ no sporophores developed. Single pinheads were overgrown with mycelium. If mycelium overgrown boxes were taken from the 0.5 per cent CO₂ stream, fruitbodies occurred in an airstream without carbon dioxide (after nine days).

THE GLASSHOUSE CROPS RESEARCH INSTITUTE

Sir William K. Slater, K.B.E., D.Sc., F.R.I.C., F.R.S., has been appointed Chairman of the Governing Body of the Glasshouse Crops Research Institute in succession to Mr. T. Ainslie Robertson.

Sir William, the Secretary of the Agricultural Research Council from May, 1949 until June of this year, will assume office on the 1st October on the retirement of Mr. Ainslie Robertson, who has been Chairman of the Governing Body since 1953.



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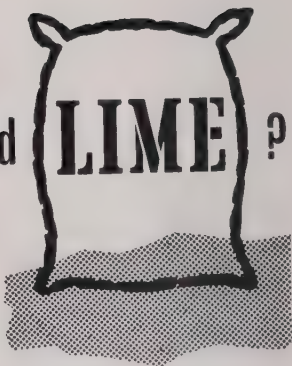
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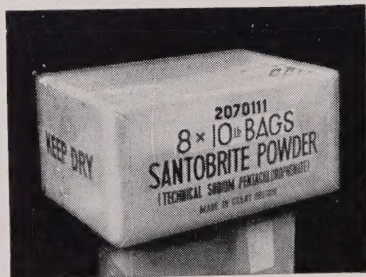
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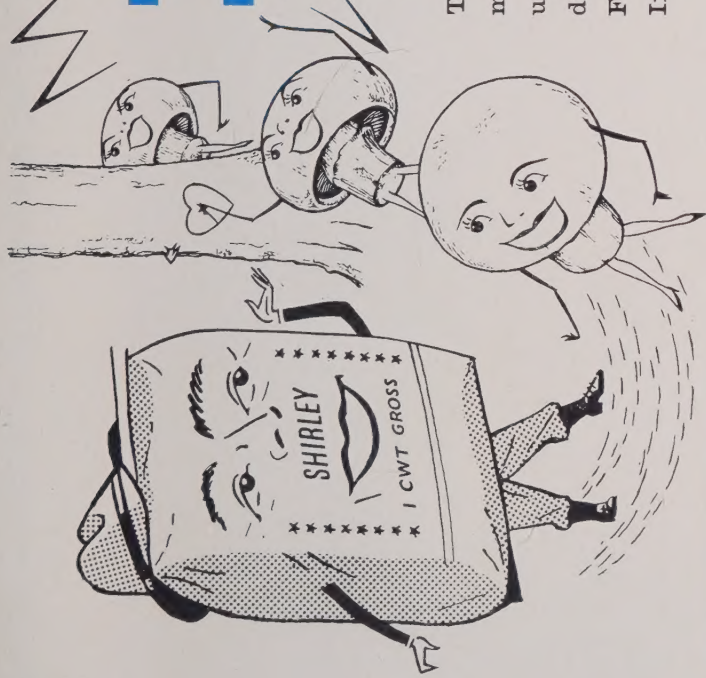
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